The present thesis deals with different aspects of the chemistry and photo-biology of various ferrocene-conjugates, their interaction with double helical DNA, DNA photocleavage and photo-enhanced cytotoxicity in visible light, localization and cellular uptake to study the mechanism of cell death. Phenyl analogues of the active complexes have been synthesized and used for comparison in biological assays.

Chapter I presents an overview of cancer and its types, various treatments for cancer. A general overview on the Photodynamic Therapy, a new modality of light activated cancer treatment and its various possible mechanism of action, has been made. The promise of photoactivated chemotherapy is discussed with recently developed metal based antitumor agents. Biological applications of few ferrocene conjugates as anticancer and anti-malarial agents are discussed. The objective of the present investigation is also presented in this chapter.

Chapter II presents the synthesis, characterization, structure, DNA binding, DNA photocleavage, photocytotoxicity and cellular localization of ferrocene-conjugated dipicolylamine oxovanadium(IV) complexes of curcumin. To explore the role of the ferrocenyl moiety the phenyl analogue of the ferrocenyl complexes is synthesized and used as a control for comparison purpose.

Chapter III deals with the photo-induced DNA cleavage and photo-enhanced cytotoxicity of ferrocene-conjugated oxovanadium(IV) complexes of heterocyclic bases. The synthesis, characterization, structural comparisons, DNA binding, DNA photocleavage and photocytotoxic activity in visible light are discussed in detail.

Chapter IV describes the synthesis, characterization and structure of ferrocene-conjugated oxovanadium(IV) complexes of acetylacetonate derivatives. The complexes are evaluated for DNA binding, DNA photocleavage and photocytotoxic activity in HeLa, MCF-7, 3T3 cells in visible light. The fluorescent nature of the complexes is used to study the cellular localization of the complexes and the mechanism of cell death induced by the complexes is also discussed.

Chapter V presents the photocytotoxic effect of ferrocene-conjugated oxovanadium(IV) complexes of different curcuminoids in HeLa , HepG2 and 3T3 cells. Curcumin based fluorescence has been successfully used to study the cellular uptake and localization behavior of the complexes. The positive role of the ferrocenyl complex is evident from the ~4 fold increase in its photocytotoxicity compared to the phenyl analogue. The apoptotic mode of cell death is evident from nuclear co-staining using Hoechst dye.

Chapter VI describes the synthesis, characterization and photochemotherapeutic efficacy of ferrocene conjugates of N-alkyl pyridinium salts. Mitochondria targeting property of ferrocene compound having n-butyltriphenylphosphonium group has been studied by JC-1 assay. FACS analysis showed significant sub G1/G0 phase cell-cycle arrest in cancer cells on visible light treatment.

Finally, the summary of the dissertation and conclusions drawn from the present investigations are presented.

The references in the text have been indicated as superscript numbers and compiled at the end of each chapter. The complexes presented in this thesis are represented by bold-faced numbers. Crystallographic data of the structurally characterized complexes are given in CIF format in the enclosed CD (Appendix-**I**). Due acknowledgements have been made wherever the work described is based on the findings of other investigators. Any unintentional omission that might have happened due to oversight or mistake is regretted.

INDEX WORDS: Ferrocene conjugates · Crystal structure · DNA binding · DNA photocleavage · Photocytotoxicity · Vanadium · Cellular Imaging

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